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Bulletin 318 May, 1930

REPORT OF THE DIRECTOR

For The Year Ending October 31, 1929

Connecticut
Agricultural Experiment Station
New Haven

CONNECTICUT AGRICULTURAL EXPERIMENT STATION

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REPORT OF THE DIRECTOR

For the Year Ending October 31, 1929

To the Board of Control of the Connecticut Agricultural Experiment Station:

In discussing the events of the past year there comes to mind at once the death of Dr. Thomas B. Osborne whose outstanding work in biochemistry and nutrition brought fame and honor, not only to himself but to the Station where he spent his entire professional life. A memorial is now being prepared, to be published as a Station bulletin, in which we have tried to record our high regard for our fellow worker and friend. It will include certain unpublished papers of Dr. Osborne, a complete bibliography and a number of biographical and personal papers.

Mr. Charles R. Treat of Orange, for many years a member of the Board of Control and in recent years its vice-president, died in February. To the Station this was a great loss. Mr. Treat's interest in the work of the Station was always active, intelligent and helpful; his judgment was sound and his time freely given.

Each year brings new problems to the farmers of the state and many of these are passed on to the Station. The spread of the European Corn Borer, the Japanese Beetle, the Oriental Peach Moth and other insect pests has placed unusually heavy burdens upon us. The Peach Moth has become a major pest in many orchards and at the request of the growers we have undertaken an attack along the line that is now most promising, namely, the rearing and distribution of parasites. In September a fund was subscribed by the growers and a special allotment of $5,000 made by the State Board of Finance and Control. Work was begun immediately, involving the building and purchase of a large amount of equipment and the employment of two assistants. It is hoped that sufficient numbers of two parasites to bring about substantial control can be reared for release in peach orchards next June.

Other new enterprises are the inauguration of the plan to eradicate the black currant, an alternate host of the White Pine Blister Rust; the establishment of a field station at Windsor for the growing of forest planting stock, vegetable breeding and soil fertility studies. Mention should also be made of the enactment of a "pure seed law" by the General Assembly of 1929, under which the Station has accepted the task of examining the samples collected by the Commissioner of Agriculture.

Thus it will be seen that our duties are constantly increasing. The last addition to our building space was in 1912, when the main

laboratory was enlarged. To-day with a staff doubled in size we are very seriously crowded, with the result that it is increasingly difficult to carry on our work. New problems require new equipment and facilities which we are at present unable to house. At the last session of the General Assembly, an item of $45,000 for a new laboratory was included in our estimates, but this was eliminated from the budget. I present this as our greatest need and recommend that it be included in the estimates to be presented next fall.

CONTROL AND INSPECTION WORK

Inspection of Fertilizers, Feeds, Foods, Drugs, etc.

In accordance with the statutes relating thereto, the Analytical Chemistry Laboratory has analyzed 900 samples of *Fertilizers and Fertilizer Materials.* The report on these was published and distributed before the middle of December.

Similar control work on *Feeding Stuffs* has involved chemical analysis of more than 800 commercial and other fodder materials, many of which have had microscopic examination.

A report, Bulletin 307, upon food products and drugs summarizing inspection and analyses of 1320 samples, largely submitted by the Dairy and Food Commissioner, was issued in May of this year, covering the work done in the previous year. An equal volume of analytical work has been required in this branch of the service during the current year.

Statutes requiring the certification of *Glassware* used in the Babcock test for fat in milk and cream, and of thermometers to be used in dairies for checking pasteurization temperatures, have involved the examination of 2746 pieces.

No systematic inspection of *Insecticides* and *Fungicides* has been made but a considerable number of spray materials submitted by purchasers and others interested have been examined. A useful compilation of analyses (160 pages), of insecticides, fungicides, bactericides, rodenticides and weed killers was prepared and published in January of this year as Bulletin 300.

The department has also done a very considerable amount of analytical work in collaboration with the Tobacco Substation at Windsor and the Experiment Station at Storrs. Analyses of special foods have been made from time to time in coöperation with the American Medical Association's Council on Pharmacy and Chemistry. A review of the literature on color reactions for vitamins has been made and submitted to the Association of Official Agricultural Chemists and will be published in the journal of that

association. The laboratory has also continued to take part, with other control laboratories and industrial and trade laboratories in the United States, in programs of check analyses on cottonseed meal and on various fertilizer mixtures. And finally, the department is always interested in the examination of new food products and in special and miscellaneous food to the extent that time and facilities permit.

Control of Insect Pests

There has been no particular spread of the *Gipsy Moth* in Connecticut during the season. As in 1928, there was no noticeable defoliation of trees in Connecticut, but larger areas were stripped in Massachusetts, Maine and New Hampshire than ever before. We believe that this relative freedom from injury is due in large measure to the careful and thorough work in scouting and spraying carried on year after year in coöperation with the Federal forces.

The *Satin Moth* has continued to spread westward, and a State quarantine conforming with the Federal quarantine was placed on the eastern half of the State, effective March 15, 1929. The Federal quarantine was later revised, effective November 1, 1929.

The *European Corn Borer* has made an extensive spread, especially from the two-generation area in the eastern portion of the State. The entire State was scouted by Federal men and the pest found in 39 new towns. In revising quarantines, it has seemed best to include 30 of these infested towns together with seven towns not yet found infested but surrounded or nearly surrounded by infested towns, leaving nine towns in which clean-up work will be done.

The last General Assembly enacted a compulsory clean-up law, as a means of corn borer control, the compulsion depending upon orders and regulations issued by the Director of the Station for the quarantined area only. Federal agents patrolled the main highways along the margin of the quarantined area from July 15 to October 15.

There has been no important spread during the season of the *Japanese Beetle*. Federal agents scouted more than 60 of the cities and larger towns along the principal lines of traffic and shipping, and the only new infestation discovered was at Willimantic, where 21 beetles were found. Soil treatment was carried on at Hartford and New London in the infestation centers discovered in 1928, and where grubs were found. Notwithstanding this treatment, more beetles were caught in traps in both cities in 1929 than were found in 1928. Road patrol was maintained between June 15 and October 1 on the main highways leading out of the larger quarantined areas.

The only infestation of the *Asiatic Beetle* discovered outside of the quarantined towns of New Haven and West Haven was in a small private yard in Bridgeport. On an inspection tour for lawn injury, approximately 52 towns were visited, mostly in the central and western portions of the State outside the Japanese beetle quarantined area, but no signs of infestation were found. The insect has been found in New Haven outside of the former infested area.

There has been an increase in the number of nurseries, all of which have been inspected since July 1 by the Station entomologists. We have also inspected the fruit and rose stocks imported from Europe for propagation in Connecticut nurseries.

In the *Mosquito Elimination* work very substantial progress has been made. New ditching in Old Lyme started in 1928 was continued in the spring of 1929, until the appropriation of $5,000 was exhausted. Another $5,000 was appropriated and work is now going on. Ditches are now being cut in Hamden and all of the salt marsh area in that town will soon be completed. Many ditches were recut in the East River section of Madison, and all ditches have been maintained except in certain portions of Madison and Guilford.

Distribution of Forest Planting Stock

During the calendar year 1929, the Station distributed 1,458,000 trees for forest planting, shelter belts and wind breaks; at least 99 per cent was for forest planting purposes. Of the entire amount, 463,000 trees were sent to farmers under the Clarke-McNary Act. The rest went to water companies, manufacturing plants, estate owners and others. This is an increase of 10 per cent more than the number distributed in 1928, showing an ever increasing interest in reforestation.

White Pine Blister Rust

During the season of 1929, 134,407 wild Ribes and 10,922 cultivated Ribes were destroyed on 34,597 acres, in 20 towns. Approximately 18 per cent of the acreage covered was re-eradication work.

Nursery Sanitation Zones have now been established around 11 nurseries, including one area established this year. The ten previously established zones were rechecked. Five thousand nine hundred and sixty acres were inspected on this project this year and 1,182 wild Ribes and 1,814 cultivated Ribes removed.

The European Black Currant law, effective July 1, 1929, gives the Director the authority to conduct a state-wide campaign on the

elimination of this plant, which is an alternate host of the Blister Rust. The presence of this species of Ribes constitutes the most serious menace to the white pine.

SUMMARY OF WHITE PINE BLISTER RUST CONTROL, 1928-1929

Year	Initial erad. ac.	Re-erad. acres	Total ac. erad.	Wild Ribes destroyed	Cult. Ribes destroyed
1925	6,688	40	6,728	258,515	684
1926	21,687	570	22,256	182,826	330
1927	12,068	8,836	20,904	159,121	2,235
1928	68,539	1,122	69,661	123,383	1,151
1929	28,394	6,203	34,597	134,407	10,922

Seed Testing

For more than 50 years seed testing for farmers has been one of the Station's activities, it having pioneered in this work. The General Assembly of 1929 passed a statute requiring that all seeds, except of vegetables and flowers, be labeled as to germination and purity. The Commissioner of Agriculture is charged with the administration of the act, and the Station is making the examinations. This will increase the duties of the Botany Department and some provision should be made for financing the work.

Spray Service

The spray service, so popular among fruit growers, is carried on in coöperation with the Extension Service of the Connecticut Agricultural College. The Station botanists and entomologists maintain constant touch with the development of fungous and insect pests and by use of special weather data furnished by the New Haven office of the Weather Bureau, are able to advise orchardists as to the time of the several spray applications. The warnings or "bulletins" are telephoned to the several County Agents, who in turn send them out over a previously arranged telephone chain.

PROGRESS OF INVESTIGATIONS

Here follow brief notes on those projects of special interest or on which definite results have been obtained during the year. No attempt is made to discuss all of the investigations under way, a list of which will be found on page 766.

Biochemistry

Cell Chemistry. The investigation of the tobacco leaf has been continued throughout the year. Existing methods for the determination of nitrate, ammonia and amide nitrogen have been so modified as to become applicable to tobacco which, owing to the presence of the volatile alkaloidal base nicotine, presents unusually difficult analytical problems. Pure specimens of nicotine have been prepared by a method especially developed for the purpose and the dissociation constants of this base have been determined. Curves drawn with the knowledge of these constants form the basis of a new method for the determination of "free nicotine" in tobacco, a matter of some importance in the judgment of tobacco quality. Three papers embodying the results of this work have been published.

Protein Chemistry. Two papers on the basic amino acids of crystallized horse hemoglobin and of the keratins of human hair respectively have been published in the *Journal of Biological Chemistry.* These investigations were undertaken as illustrations of the application of the recent modifications of the methods of base analysis to proteins with unusual distributions of amino acids. An investigation of methods for the preparation of the sulfur-containing amino acid cystine has been carried out as well as an investigation of the compounds that this substance forms with silver and copper. A method for the separation of cystine from histidine has been developed and employed in the analysis of the keratins of human hair.

Nutrition. An elaborate experimental investigation of the effect of certain inorganic constituents of the diet on the growth of bone tissue has been planned and in part completed. Various phases of this investigation are being conducted with the collaboration of scientists of other institutions, notably Yale University, the Johns Hopkins Medical School, and Vanderbilt University. This investigation is founded on a method of varying the proportions of the determining factors in the diet that was developed in this laboratory recently.

An investigation of the vitamin distribution in watercress has been completed. This widely used salad "green" has been shown to provide a rich source of vitamins A and E as well as a moderately rich source of B.

A study of the curious phenomenon known as "refection" in the rat has been completed. The existence of refection in a rat colony renders the investigation of vitamin B-bearing tissues difficult, if not impossible. The failure of our attempts to produce this phenomenon in our animals was therefore gratifying.

The biochemical laboratory has also coöperated with Dr. F. G. Benedict of the Nutrition Laboratory of the Carnegie Institution

of Washington at Boston in a study of the fundamental characteristics of the basal metabolism of the rat. The effect upon the basal metabolism of the rate at which the animal has been grown has also been investigated. It is now possible to grow animals at any prescribed rate within the growth capacity of the species and the detailed study of animals that have been grown at widely different rates is expected to lead to valuable conclusions regarding the optimal rate of growth.

The annual grants of the Carnegie Institution of Washington first made in 1904 to the late Dr. Thomas B. Osborne, and since 1912 jointly to Dr. Osborne and Prof. Lafayette B. Mendel, have broadened the scope of the Station's work in the field of biochemical investigation. This generous financial assistance has been continued through the current year by a grant to Professor Mendel and Dr. Vickery.

Botany

The Willow Scab Fungus. Work on this disease has continued. It was found in North America for the first time in 1927 by the Station Botanist, although it had been known for some years in Europe. Bulletin 302, March, 1929, presents the results of the investigation up to that time. During the past year further data have been obtained on the occurrence of this disease in the United States and Canada, on control by spraying and on the life history of the fungus itself.

Chestnut Blight. Some hope exists that the virulence of this fungus may decrease as time passes, and that we may in the future hope to reestablish this very valuable forest tree. Several lots of chestnut seedlings have been planted in various parts of the state to determine the amount of natural infection; also regular observations are being made at two locations on native trees under forest conditions to determine the spread of the fungus.

Damping-off of Vegetable Seedlings. This constitutes a source of considerable loss each year to the vegetable industry on both greenhouse and field crops. Various soil treatments are being compared in an effort to find one that is both effective and practical. Excellent results have been obtained by the use of acetic acid and formalin.

Entomology

Asiatic Beetle. The results of the investigations on the life history, habits and methods of control of the Asiatic beetle have been published as Bulletin 304. Work on the control of this insect by applying lead arsenate in varying amounts to the soil has been continued, as well as tests for the effect of such applications

on the germination and growth of the different kinds of grasses used in making lawns. New plots on several lawns in Westville were laid out to check work previously done with lead arsenate and to assure a correct method of application per unit area. Observations will continue for a few years.

Oriental Peach Moth. An investigation on the life history, habits and control of the Oriental peach moth has been under way for several years and the data have been assembled in Bulletin 313. No satisfactory control by means of applications has yet been discovered. Consequently, control or partial control by parasites has been given considerable attention. In the late summer a request was received from the Connecticut Pomological Society that the Station undertake to rear these parasites and distribute them in peach orchards in 1930. A study of possible methods was made and a constant temperature room and a work room were fitted up with the necessary cages and apparatus, and an electric refrigerator was installed. A portion of the greenhouse was assigned to this work and strawberry plants were grown in order to rear the strawberry leaf-roller, which is a host to one of the parasites, the *Macrocentrus ancylivora.*

Mexican Bean Beetle. During the summer, the Mexican bean beetle was found to be present in certain towns in Fairfield, Litchfield, Hartford and New Haven Counties, in the western half of the State. The first discovery was made by Dr. E. P. Felt, of Stamford. It is questionable whether this insect will become a serious pest in Connecticut, as it is thought to be near its northern limit. However, it has seemed best to conduct a brief study of the life history of this insect and methods of controlling it in Connecticut and therefore a new project is added to the list.

Cabbage Root Maggot. Investigations were carried on in the control of the cabbage root maggot, principally to determine whether or not the gains in yield were justifying the expense of the control methods. This project will be continued for another season.

Squash Vine Borer. Insecticides were used directly on the larvae of the squash vine borer to see whether the control of this pest could be made more effective.

Forestry

The Rainbow Forest. Originally planted to both conifers and hardwoods, this experimental forest is now essentially coniferous, the hardwoods having succumbed to disease, insects and unfavorable conditions. The soil is very sandy, too much so for cultivated crops or pasture and was selected as representing one type of our sub-marginal land. The plantings are in blocks of one or two

species and constitute not only a trial of the various species of conifers, but of various spacings. As they have grown, experiments in thinning, pruning and other silvicultural practices have been possible. A complete discussion of the results up to 1924 is available in Bulletin 262.

Work during the year has included very little planting but considerable thinning. Several new sample plots have been laid out and the thinnings have been extended to other plantations which were in need of such treatment.

In coöperation with the Soils Department a study of pine leaf litter and its effect on sandy soil was begun. Several plots were laid out, from which the leaf litter was removed or treated in such a way as to alter its character, by burning or otherwise, so that a comparison might be made later with the check area where the litter was left in its natural condition. There is reason to believe that pine needles unmixed with hardwood leaves have a deleterious effect on soil conditions rather than otherwise. It is hoped that some definite data on this point will be secured through this experiment.

Treatment to Prolong the Life of Native Woods for Tobacco Shade Poles. The coöperative demonstration at the Tobacco Substation is being continued although no new posts have been set. It is planned to try out some other species in addition to those already under test.

The Distribution and Rate of Growth of the Forest as Influenced by Soil Conditions. The studies on the rate of growth of red pine in pure plantations have been continued and the result prepared for publication. Normal growth curves have been prepared, thus providing a "yardstick" by which growth on different sites can be computed to a common age and the quality of sites compared.

Plant Breeding

Hereditary Characters in Corn. The inheritance and linkage relations of a sterile tassel condition have been studied further and its possibilities for use in the production of crossed seed corn determined. This character is being introduced into the seed-parental stock of Canada-Leaming to be used in growing hybridized seed without detasseling. Other characters including sugary with abnormally high and low segregation, are being studied further.

Effects of Inbreeding and Crossing Upon Corn. The investigation bearing upon conflicting theories as to the interpretation of hybrid vigor is being continued but has not reached a stage where progress is to be reported.

Improvement of Naturally Cross-Fertilized Plants. Canada-Leaming, a cross of inbred strains of Canada Yellow Flint and

Leaming, has been tested the second year in Massachusetts, Vermont, New Hampshire and Maine and in spite of the unfavorably dry season has been outstanding in many places in its early maturity, large stalk growth and heavy production of grain. This companion of Burr-Leaming combines many of the qualities of earliness and hardiness of the flint type with the large stalk growth and grain yield of the dent type.

About 400 first generation crosses of inbred strains of Whipple's Early Yellow sweet corn were grown in a preliminary trial for a market garden type of sweet corn having the uniform size and shape of ear and even maturity characteristic of crossed corn. Some 30 of these have been selected for further trial.

A new hybrid type of canning Evergreen sweet corn has been tested three years. This has been named Green Cross and will be distributed to canners and seed growers in 1930.

A new variety of Early Yellow sweet corn called Spanish Gold has been developed by crossing an amber-colored flint corn from Spain with Alpha white sweet and Gaspe flint and other varieties of extreme earliness. The new variety in the trials at Mount Carmel has ripened earlier and produced somewhat larger ears than any other extra early variety grown in comparison with it. Seed will be distributed for general trial in 1930.

New varieties of straightnecked squash, early pepper, and spinach are ready for distribution for trial by market gardeners under various soil conditions and different methods of handling.

Preliminary results of inbreeding and crossing strawberries show that this plant behaves much the same as corn. With the added advantage of vegetative propagation it is to be hoped that valuable varieties can be originated in this way. Inbred strains of Harvard 17, Chesapeake and Glen Mary are being grown in the greenhouse for the purpose of making many crosses in a further test of this method.

Black raspberries show no reduction in growth or fruitfulness after two generations of self-fertilization. Strains differ in size, form and number of fruit as well as in cane and foliage color and other details of vegetation. Some strains are uniform and come true to type from seed. A comparison of seed propagation with tip-layering will be made to see if there is any advantage in the former method. Black raspberry plants are easily grown from seed and since these seedlings start free from mosaic there is a definite advantage in this method of propagation.

Improvement of Naturally Self-Fertilized Plants. The root-rot resistant strains of shade tobacco have continued to show a noticeable superiority in this respect over the variety generally grown. The origin and inheritance of this character are being studied. A combination of some of the growth characters of Round Tip tobacco with the quality and leaf characters of Cuban Shade is

being attempted. Several selections in this material are being tested for uniformity, growth habit and leaf quality.

A new variety of tomato combining the earliness of Alacrity with the shape and color of Bonny Best is being tested on various soils under market garden conditions.

Soils

Nutrient Requirements of Connecticut Soil Types. During the past four years 70 different soils representing practically all the important soil types of the State, under various conditions of former treatment, have been carefully studied as to plant food constituents and acidity as shown by chemical analysis, and as to the response of crops to various combinations of nitrogen, phosphorus and potassium, both with and without lime, under greenhouse conditions. The crops used include tobacco, alfalfa, lettuce, beets, carrots, cabbage, turnips, oats, buckwheat and sweet corn. These respond to lime in the following order from highest to lowest lime requirement of the crop: Lettuce, alfalfa, beets, carrots, cabbage, turnips, sweet corn, oats, tobacco and buckwheat.

Of the 70 soils, 67 need lime for lettuce, 64 for alfalfa, 60 for beets, 58 for carrots, 50 for cabbage, 43 for turnips, 40 for sweet corn, 34 for oats, 9 for tobacco and 4 for buckwheat.

Nitrogen response under greenhouse conditions is so abnormally low, due to the favorable conditions for liberation of nitrogen from the soil, that no definite conclusions can be drawn. Of all the crops grown, oats appear to show the most marked response to nitrogen. Tobacco is the only other crop that has shown definite symptoms of nitrogen deficiency on any appreciable number of soils.

Phosphorus is a serious limiting factor for nearly all crops grown in the case of 63 of the 70 soils. Three old tobacco soils included in the list failed to show response to phosphorus. Alfalfa, tobacco and turnips were almost complete failures on soils that are particularly low in this element. Data is somewhat irregular for other crops, but the approximate order of response to phosphorus was alfalfa, tobacco, turnips, sweet corn, cabbage, lettuce, carrots, oats, buckwheat.

Potassium is of such low availability that only six of the 70 soils fail to show measurable response. However, the majority of the soils produce somewhat higher yields without potash than without phosphorus. Differences in the potash requirement of the various crops are not sufficiently great to justify any statement as to order of response for the crops grown. Alfalfa and tobacco are the only ones that suffer markedly when the soil fails to supply sufficient potash.

Two other malnutritional abnormalities of tobacco have appeared

on some of these soils. On three very acid soils tobacco has shown symptoms of an excess assimilation of manganese (manganese toxicity). On several heavily limed soils where the fertilization has been deficient in nitrogen or potassium or both, a physiological trouble known as "frenching" has appeared. Factors affecting the occurrence of these troubles are being studied more fully.

Two year old maple transplants failed to show any consistent differences in growth on nine soils on which tobacco had previously shown marked response to the various nutrients. The experiment with young maple transplants will be continued for several years under outdoor conditions on a soil of marked nutrient deficiency.

In general, it may be stated that the soil type is less important than the past history of the field in determining the present nutrient requirements of the soil for the various crops. However, under field conditions, differences in the physical character of the soil, topography and stoniness will be of paramount importance in determining economic response to fertilizer and lime treatment.

Farm Soil Surveys. During 1928 and 1929 nearly two hundred farms in the towns of Woodstock, Griswold, Coventry, Brooklyn, Columbia, Stonington, North Stonington and Canterbury have been carefully surveyed as to soil types on the various fields of the farm. This is part of a project, the "Economic Significance of Soil Type," conducted in coöperation with the Agricultural Economics Department of the Storrs Agricultural Experiment Station. Soil acidity tests of practically every field on the above farms, a total of nearly 1500 tests, gives the following results:

0.5% of fields—neutral or above (7.0 + pH)
12.9% of fields—slightly acid (6.2-7.0 pH)
28.1% of fields—moderately acid (5.4-6.2 pH)
56.0% of fields—strongly acid (4.6-5.4 pH)
2.5% of fields—very strongly acid (3.8-4.6 pH)

Available phosphorus tests of all soils collected from three of the above towns show the following indications:

1.3% of fields—very high test (40 lbs. + per A)
4.7% of fields—high test (20 lbs.-40 lbs. per A)
6.6% of fields—medium test (10 lbs.-20 lbs. per A)
31.1% of fields—low test (5 lbs.-10 lbs. per A)
56.3% of fields—very low test (less than 5 lbs. per A)

A serious deficiency of available phosphorus undoubtedly exists on dairy farms in the highland regions of the State.

Leaching Experiments. During the spring of 1929 a battery of lysimeters was constructed at the Tobacco Substation in Windsor. This includes a long concrete-walled chamber built underground except for windows and roof, with raised earth platforms on each

side and at one end, in which the drainage cylinders are imbedded. The bottoms of these cylinders drain into brass, tin-lined tubes which lead through the walls and drain into collecting tanks on shelves along the walls of the chamber. The drainage cylinders, or lysimeters, are 20 inches in diameter. Thirty-four are 10 inches in depth while 34 are 20 inches in depth, the former filled with a seven-inch depth of surface soil, while the latter have also a ten-inch layer of subsoil. The capacity of the equipment provides for 34 additional lysimeters 30 inches in depth which have not yet been installed. This equipment, built at a cost of $3.000, compares favorably with any other of its kind elsewhere and is the only apparatus in operation in New England that provides for collection and analysis of the soil and fertilizer constituents that are lost through leaching.

The first problem to be undertaken is a study of the losses occurring under heavy applications of various types of nitrogenous fertilizers. Sixteen different sources of nitrogen and four different types of soils are under investigation. The current season was exceptionally dry and practically no drainage water was collected until the entire crop was destroyed by hail on July 31. Much valuable data has since been collected which will be published later.

Forest Soil Studies. In coöperation with the Forestry Department of this Station, an intensive study of the soil factors affecting the site quality for red pine in plantations is being continued. Typical soils under various conditions of forest cover are being investigated in the laboratory as to biological, chemical and physical characteristics of the various soil horizons. Results to date indicate that the micro-organisms of the soil are most active in the fresh litter. In this layer organic nitrogen is being rapidly transformed into ammonia. Only a small part of this is transformed into nitrates in a three months' incubation period, except on soils of slight acidity. Ammonification occurs to a lesser degree in the older humus layer, which lies beneath the litter in forest soils where "mull" formation is not active. Nitrate formation rarely occurs in this type of material. The more favorable "mull" types, under hardwood cover, usually show nitrate production in the surface layer of mineral soil.

Three main groups of forest soils are represented in Connecticut. The first of these, the "podsol type," has a definite layer of light gray mineral soil occurring just beneath a thick humus covering. Below this gray layer are layers of dark coffee brown or rust brown color. This type is most general under hemlock-white pine-hardwoods associations in the northern part of the State, although it occurs locally in oak and beech forests in southern Connecticut. The second, or "mull type," has no older humus layer under the leaf litter, and the upper mineral soil is dark brown in color and of

a mellow, crumb-like structure. Earthworms are active. This type is characteristic of the best hardwood forests, where ash, elm, basswood, black and yellow birch and hard maple predominate.

A third or intermediate type has no definite gray layer beneath the forest humus, but there is an accumulation of leaf mold, and the upper mineral soil is firm and compact, with no earthworm activity to mix and mellow the soil. This is the most common type on the second growth and sprout hardwoods forests with a predominance of red and scarlet oak.

An important object in further research is to determine the factors that produce these forest soil types and to predict the effect of various silvicultural practices in modifying them.

Tobacco Substation

Despite the fact that the entire crop of tobacco on the station farm was ruined by hail August 1, satisfactory progress has been made on most of the active projects.

Shade Tobacco Resistant to Black Rootrot. The 4R strain that was found two years ago has proved this year to be very highly resistant to rootrot. This is particularly gratifying since the ordinary strain of Cuban shade tobacco is very susceptible to this disease and the losses have been very large. This should make it possible to grow shade on many fields that have been abandoned because of black rootrot.

Depressing Effect of Stable Manure. Tobacco was stunted and unusually poor on plots that received annual applications of stable or "adco" manure for four successive years. On these plots, the manure was used *in addition* to the regular commercial fertilizer application. The unusually dry season probably accounts for this behavior of the crop, which is quite different from the results of the wet seasons of 1927 and 1928.

Cause of Poor Combustion of a Dry Year Crop. Chemical comparison of tobacco of a dry season (1924) and a wet season (1927) shows the poor burning tobacco of the dry season contained more calcium, magnesium, phosphorus, sulfur, chlorine and nitrogen, all of which may be injurious to burn as measured on the leaf, while the good burning crop was distinguished by the increased potash, which aids combustion. Also the alkalinity of the water soluble ash of the wet year crop was higher. This is considered a good index of combustability.

Seasonal Fluctuation in Soil Reaction. In trying to find the optimum soil reaction for tobacco production it will be necessary to take into consideration the period of the year when the test is made. On plots where monthly tests have been made for the past two years the reaction was found to be highest in December and lowest in June, the extreme variation being from .5 to 1.0 pH unit.

FIELD DAY

The Station field day at the Mount Carmel Farm, August 29, was one of the most successful we have ever had. Five hundred visitors gathered at the farm to inspect the experimental plots and to take part in the program. President George A. Works of the Agricultural College and Dr. E. W. Sinnott of Columbia University gave the principal addresses.

The Tobacco Substation Field Day was also well attended. Fifty of the visitors were members of a party of tobacco growers from Canada, who made this one of the important features of their tour.

The abandonment of the State Fair at Hartford relieved the staff of the very considerable task of preparing an exhibit. Several smaller exhibits were sent to town fairs.

LIBRARY

About 900 accessions of permanent value were added during the year to the Station library. Journals purchased now number 85, in addition to which some 30 farm journals and about 24 foreign agricultural journals are received regularly in exchange. The total number of bound volumes is now about 17,000.

PHYSICAL EQUIPMENT

The most extensive addition to the Station's equipment is the lysimeter installation at Windsor, mentioned elsewhere. Also the rat room of the biochemical laboratory has been completely renovated, new steel shelves and tables being installed. Other items are: a Pfaudler vacuum still, two electric refrigerators, a hydrogen sulfide apparatus, a Hobart chopping device for preparing forest litter samples, and a Parr combustion equipment for determining soil organic matter.

CHANGES IN STAFF

Appointments:

Henry Bull, M.F., Assistant Forester, August 1, 1929.
Miss Dorothy Amrine, B.Litt., Editor, July 1, 1929.
O. E. Street, M.S., Plant Physiologist, Tobacco Substation, July 1, 1929.
Mrs. Catherine R. Miller, M.A., Secretary Plant Breeding and Soils Departments, September 1, 1929.

Resignations:

Mrs. Mary B. Hunter, Secretary Plant Breeding and Soils Departments, August 31, 1929.

ACTIVE PROJECTS, 1929-1930

Analytical Chemistry

Dr. E. M. Bailey in charge

1. Inspection of Fertilizers.
2. Inspection of Feeding Stuffs.
3. Inspection of Foods and Drugs.
4. Calibration of Babcock Glassware and Thermometers.
5. Inspection of Insecticides and Fungicides.
7. Analysis of Special and Miscellaneous Foods.

Biochemistry

Dr. H. B. Vickery in charge
In Collaboration with Dr. L. B. Mendel, Yale University

1. Cell Chemistry.
   a. A detailed examination of the nitrogenous constituents of plant cells, in particular those of leaf tissues, and the further development of methods for the determination of the different forms of nitrogen in extracts of such tissues.
   b. An investigation of the nitrogenous constituents of the tobacco plant.
2. Protein Chemistry.
   a. The methods for the determination of the basic amino acids of proteins with the object of effecting improvements.
   b. Methods for the preparation of pure proteins on a large scale with the object of obtaining material for chemical and nutritional study.

Entomology

Dr. W. E. Britton in charge

3. Spraying and Dusting Experiments on Apples and Peaches. (With Botany.)
6. Control of Foul Brood of Bees. (Inactive.)
9. Insect Survey of Connecticut.
16. Experiments with the Cabbage Maggot.
17. Life History and Methods of Controlling the Oriental Peach Moth, *Laspeyresia molesta.*
18. Life History of Imported Currant Worm.
20. Life History, Habits and Control of the Imported Birch Leaf-Miner, *Fenusa pumila.*
21. Life History and Control of the Spinach Leaf-Miner.
26. Experiments on the Control of Squash Vine Borer.
27. (New) Rearing and Distributing Parasites of the Oriental Peach Moth.
28. (New) Investigations on Oil Sprays.
29. (New) Life History of the Mexican Bean Beetle.

Control Projects

10. Inspection of Orchards and Nurseries.
11. Control of Gipsy Moth. (With U. S. Dept. Agric.)
12. Elimination of the Mosquito Nuisance in Salt Marshes.
13. Inspection of Apiaries.
19. Control of the European Corn Borer. (With U. S. Dept. Agric.)
24. Control of the Asiatic Beetle. (With U. S. Dept. Agric.)
25. Control of the Japanese Beetle. (With U. S. Dept. Agric.)

Forestry

Mr. W. O. Filley in charge

1. Experimental Plantations on a Sandy Tract at Rainbow.
   a. Comparison of a wide variety of conifers and hardwoods.
   b. Methods of management for those species that have survived.
   c. Studies on growth and habits of the several species.
2. Effect of Thinning in White Pine. (At Shaker Station.)—Three

Botany

Dr. G. P. Clinton in charge.

2. The Nature and Cause of Mosaic Disease of Plants.
5. Plant Disease Survey of Connecticut.
6. *Thielavia basicola,* a Study of the Perfect Stage.
8. Spraying and Dusting Experiments on Apples and Peaches. (With Department of Entomology.)
15. Chestnut Blight, Virulence Studies.
16. Tobacco Diseases, Especially Black and Brown Root Rot. (At Tobacco Substation.)
20. Tree Diseases.
23. Rogueing as a Control for Raspberry Mosaic. (With U. S. Dept. Agric.)
24. Willow Scab, Studies of Morphology of Fungus (perfect stage, inoculations and control).
26. Tests of Various Materials for Soil Treatment in Control of Dampening-off of Vegetable Seedlings.
27. A Study of an Elm Disease in Connecticut.
28. Studies on the Identification of Apple Varieties by Seed Characters.

Control and Service

12. Seed Testing.
25. Apple Scab, Determination of Discharge of Ascospores in Connection with Telephone Spray Service.

particular attention to Tobacco and Vegetable Crops, such as lettuce, lima beans and tomatoes.

Soils

Mr. M. F. Morgan in charge

1. The general project "What Soil Characters are Factors in Determining the Agronomic Value of Utilization of Land" has developed into five distinct phases as follows:
   a. A descriptive inventory of Connecticut soil types, in relation to their adaptation for crops, pasture and forest.
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   c. Studies on growth and habits of the several species.
2. Effect of Thinning in White Pine. (At Shaker Station.)—Three Grades of Thinning.
3. Effect of Thinning in Hardwoods. (At Quassipaug Lake.)
5. Distribution of Forest Planting Stock. (Under Clark-McNary Act.)
6. Studies of Forest Plantations. (State-wide.)
   a. Comparative growth of various species.
   b. Reasons for success or failure.
   c. Soil and other site factors necessary for success of each species.
10. An Investigation of the Distribution and Growth of Forest Trees as Influenced by Soil Conditions and Other Site Factors.
11. Coniferous Seed Bed Study to Determine:
    a. The value of fertilizers in seed beds.
    b. The value of different amounts of seed.
    c. The value of dusts and sprays in preventing damping off.
12. A Study of Preservative Treatments of Native Woods.

Control Project

7. Control of White Pine Blister Rust. (With U. S. Dept. Agric.)

Genetics (Plant Breeding)

Dr. D. F. Jones in charge

1. A Genetic Study of Hereditary Characters in Corn Involving Their Linkage Relations and Variability, with particular attention to characters directly influencing yield.
2. The Effect of Inbreeding and Crossing upon Corn in Relation to Vigor, Rate of Growth, Productiveness and Variability.
3. Methods for the Improvement of Naturally Cross-Fertilized Plants by Selection in Self-Fertilized Lines, with particular attention to field corn for grain and ensilage, alfalfa, and to some of the more important Vegetable Crops, such as sweet corn for market gardening and canning, beets, cabbage, carrots, cucumbers, melons, onions, radish, rutabagas, squash and some Fruits such as bush fruits and strawberries.
4. Method for the Improvement of Naturally Self-Fertilized Plants, with particular attention to Tobacco and Vegetable Crops, such as lettuce, lima beans and tomatoes.

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   b. The physical and chemical characteristics of important soil types, including the nutritive response of tobacco and other plants when these soils are variously treated in the greenhouse.

c. Fertilizer experiments with vegetable crops on several typical soils in concrete frames.
d. A study of the physical, chemical and biological conditions of the soil in natural mixed and planted coniferous forests. (With Forestry Department.)
e. A study of the drainage losses and other changes that occur in several soils under heavy fertilization, as practiced for tobacco and vegetables. (Lysimeter experiments at Windsor.)

2. Experiments in Lawn Fertilization, Seeding and Management.

Tobacco Substation

Dr. P. J. Anderson in charge

1. Fertilizer Experiments: Various Sources and Rates of Nitrogen, Phosphoric Acid and Potash.
2. Field Tests with Farm Manure.
3. Field Tests with Manure Substitutes.
4. Tobacco Nutrition Studies: the Rôle of Nitrogen, Sulfur, Chlorine, Potassium, Calcium, Manganese, Boron and Magnesium.
5. Improvement of Havana Seed Tobacco.
6. Improvement of Broadleaf Tobacco.
7. Improvement of Cuban Shade Tobacco.
8. The Effect of Various Winter Cover Crops used on Tobacco Land.
9. Brown Root Rot of Tobacco. (With U. S. Dept. Agric.)
10. Studies on Black Root Rot of Tobacco.
11. Soil Reaction in Relation to Tobacco.
13. Preservative Treatment of Shade Tent Poles.
17. The Rôle of Humidity and Temperature in Curing Tobacco.

PUBLICATIONS

Bulletins

No. 296. Report on Commercial Fertilizers for 1928.
No. 297. The Effect of Topping and Suckering on Havana Seed Tobacco.
No. 298. Report of the Director for the Year Ending October 31, 1928.
No. 299. Report of the Tobacco Substation at Windsor for 1928.
No. 300. The Composition of some Commercial Insecticides, Fungicides, Bactericides, Rodenticides and Weed Killers.
No. 301. Control Studies on the Plum Curculio in Connecticut Apple Orchards.
No. 302. The Willow Scab Fungus.
No. 303. Report on Commercial Feeding Stuffs for 1928.
No. 304. The Asiatic Beetle in Connecticut.
No. 305. Report of State Entomologist for 1928.
No. 306. Soil Reaction and Liming as Factors in Tobacco Production in Connecticut.
No. 307. Report on Food Products and Drugs for 1928.

Bulletins of Immediate Information

No. 62. The Control of the Asiatic Beetle in Lawns.
No. 63. The European Corn Borer, a Menace to Corn, Vegetable and Garden Plants.
No. 64. The Japanese Beetle Quarantine.
No. 65. The Asiatic Beetle Quarantine.
No. 66. The Satin Moth Quarantine.
No. 67. Control of Ant Invasions. (Revised edition of Bulletin of Immediate Information No. 17, July, 1922.)

Journal Papers

VICKERY, HUBERT BRADFORD, and LEAVENWORTH, CHARLES S. The basic amico acids of horse hemoglobin. Jour. Biol. Chem., **79**: 377-388. 1928.

———— ———— and OSBORNE, THOMAS BURR. A review of hypotheses of the structure of proteins. Physiol. Reviews, **8**: 393-446. 1928.

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VICKERY, HUBERT BRADFORD, and PUCHER, GEORGE W. The determination of ammonia and amide nitrogen in tobacco by the use of permutit. Jour. Biol. Chem., **83**: 1-10. 1929.

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BRITTON, W. E. Report of committee on injurious insects. Proc. 38th Annual Meeting Conn. Pom. Soc., 28. 1929.

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MORGAN, M. F. Tobacco as an indicator plant in studying nutritional deficiencies of soils under greenhouse conditions. Jour. Am. Soc. Agron., **21**: 130-136. 1928.

CONNER, S. D., MORGAN, M. F., and CONREY, G. W. Soil acidity methods as applied to soil survey work. Jour. Am. Soc. of Agron., **20**: 881-892. 1928.

JACOBSON, H. G. M., and SWANBACK, T. R. Manganese toxicity in tobacco. Science, **70**: 283-284. 1929.

WHAT THE STATION CAN DO

Each mail brings to the Station requests for information and service, the range of subjects being almost without limit. Every effort is made to comply with these requests, even though they are outside the fields under investigation. This is one of the purposes for which the library is maintained. However, some of the letters request help that requires an intimate knowledge of live stock management and the like and others ask us to make laboratory determinations for which we do not have the equipment or staff. Therefore it is helpful to publish from time to time a list of the subjects on which we can furnish information and the kinds of samples we can accept.

The Station can furnish information on:

Fertilizers and fertilization.
Soils and management.
The chemical composition of foods, drugs, insecticides and fungicides.
The composition of diabetic foods.
Insect pests of plants and their control.
Fungous and other diseases of plants and their control.
Sprays and spraying.
Fruits and fruit management.
Weeds and their control.
Forestry—all phases.
Care of shade trees.
Plant breeding—especially field and sweet corn.
Lawns, establishment and care.
Bees.
Mosquito elimination.
Tobacco culture.

Samples and specimens that can be analyzed, tested or identified:

Fertilizers.
Feeding stuffs.
Foods and drugs.
Milk—except for bacterial count.
Seeds.
Weeds and other plants.
Insects.
Diseased and injured plants.
Soils.

The Station cannot furnish information on:

Live stock feeding and management including poultry.
Animal diseases.
Household management.
Clothing.
Farm management.
Marketing and coöperation.

Requests for information on these subjects should be sent to the Connecticut Agricultural College at Storrs.

The Station cannot make analyses and examinations of:

Drinking water—apply to the State Board of Health, Hartford.

Milk for bacterial content—apply to the Dairy and Food Commissioner, Hartford.

Sick or dead poultry should be sent to the Poultry Department, Storrs Agricultural Experiment Station, Storrs, Conn.

All of which is respectfully submitted.

WILLIAM L. SLATE,
Director.

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University of
Connecticut
Libraries

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